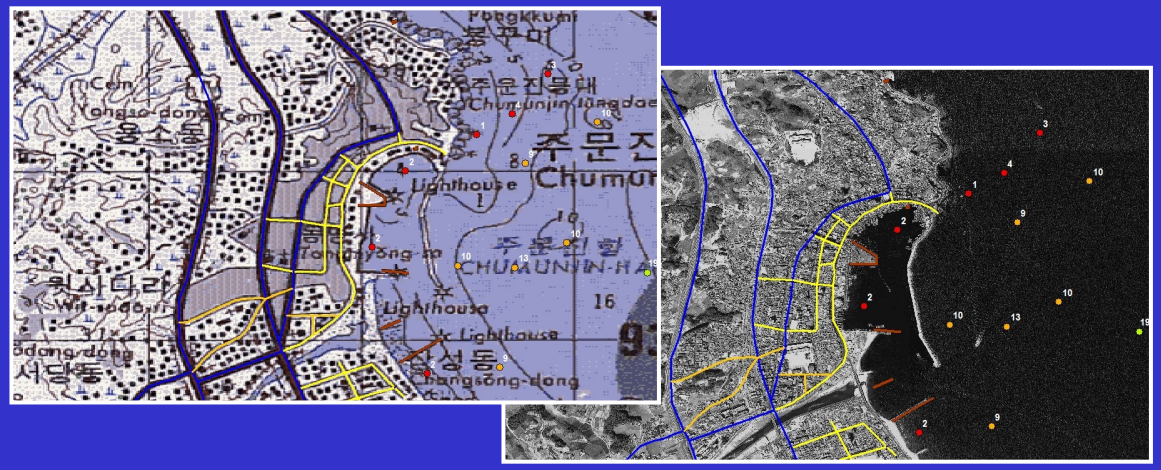
Coastal Throughput Estimation

Joint Seabased Theater Workshop
February 8 – 10, 2005

Debbie Green (ERDC-CHL)
Greg Green (ERDC-GSL)



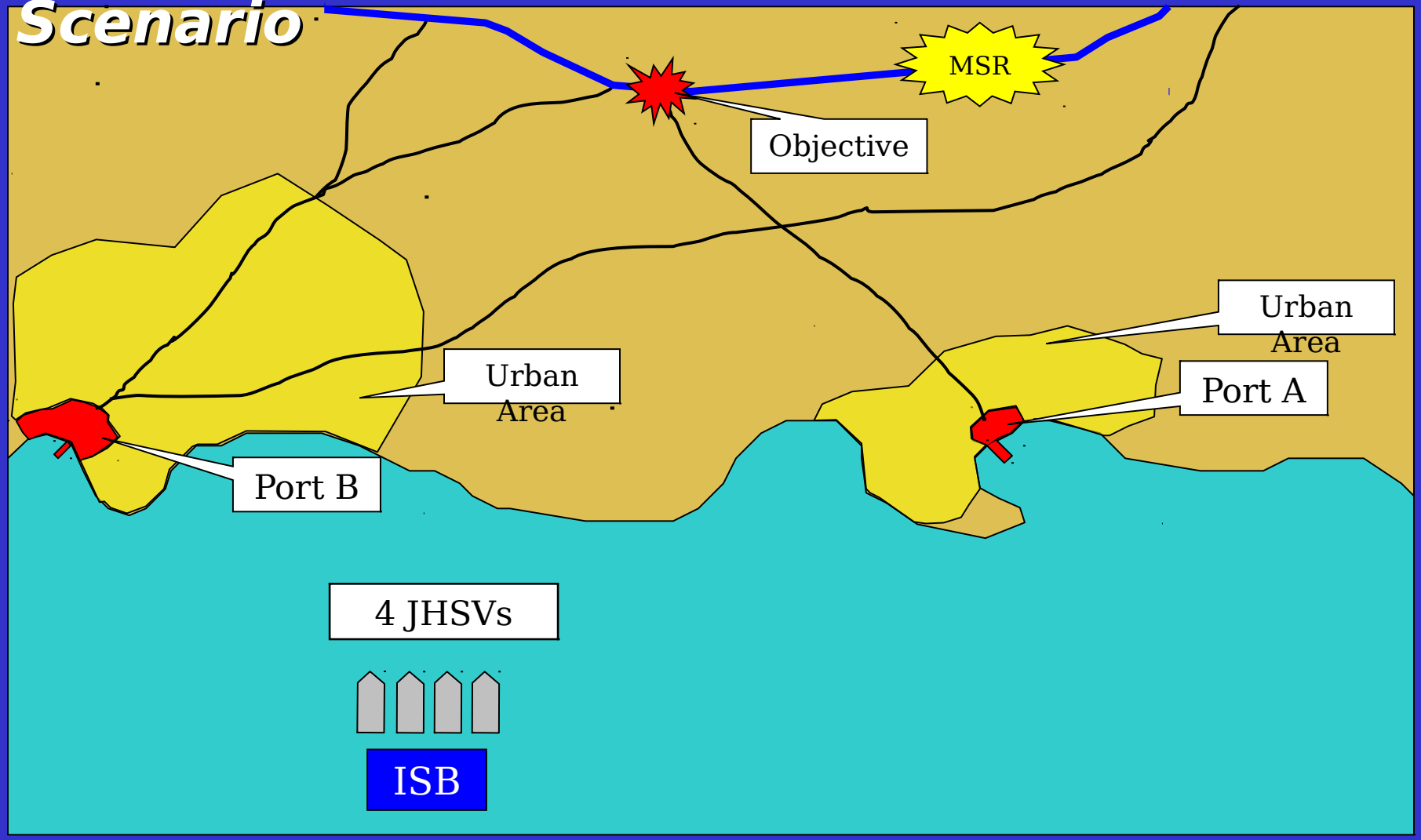
Objective/Approach

- **Objective:**

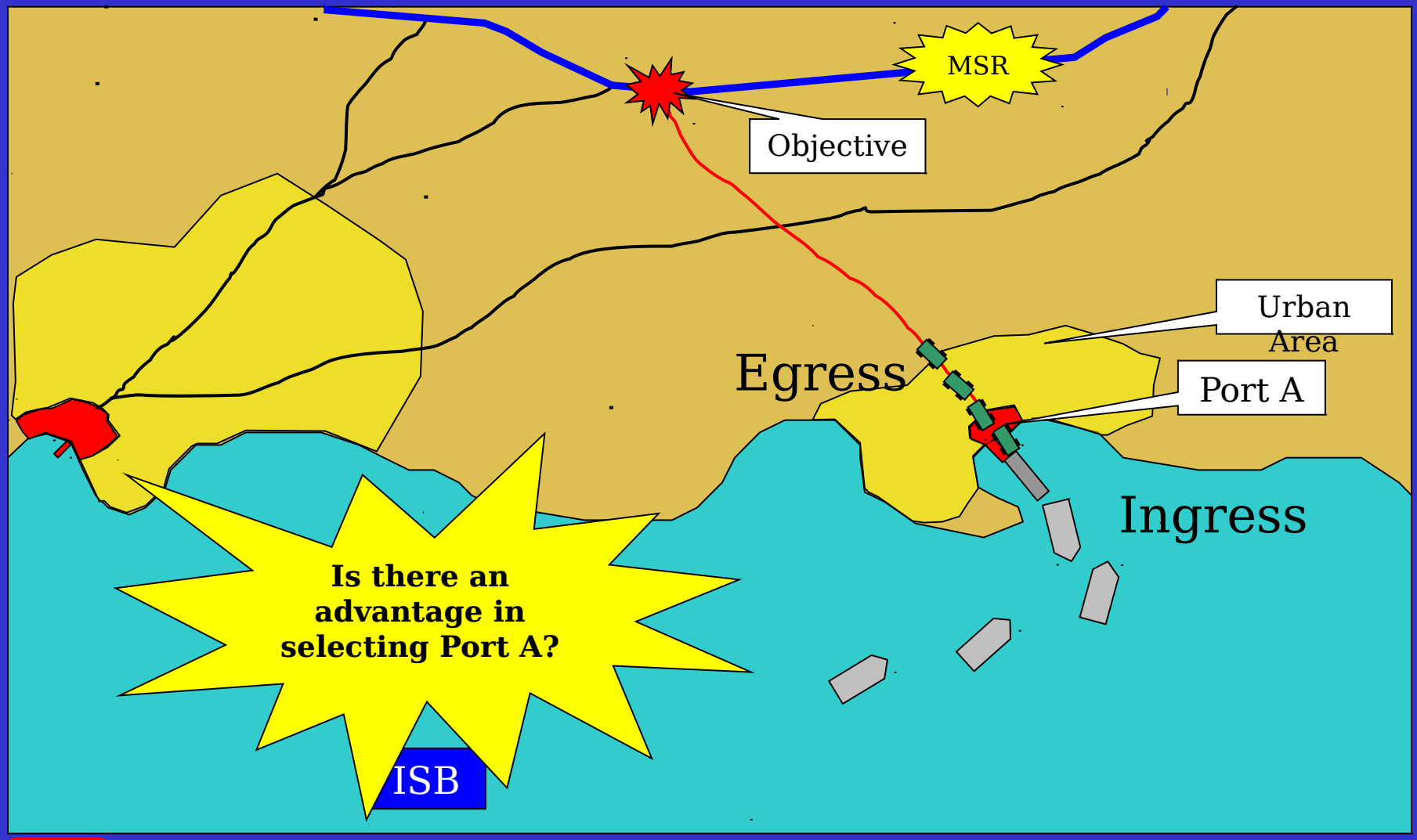
  Develop an ingress/egress throughput analysis tool for
  - Estimating **power projection** and **sustainment rates** through small ports
  - Identifying and characterizing **impediments (bottlenecks/chokepoints)**
  - Incorporation into an integrated **planning tool**

- **Approach:**
  - Identify/parameterize **environmental** and **physical factors**
  - Identify/develop parametric **algorithms** and **data**
  - Incorporate factors, algorithms, and data into ingress/egress throughput model
  - Transition validated model to a stand-alone planning tool for possible integration with models within the Surface Deployment Distribution Center (SDDC) and the Tele-Engineering Operation Center (TEOC)

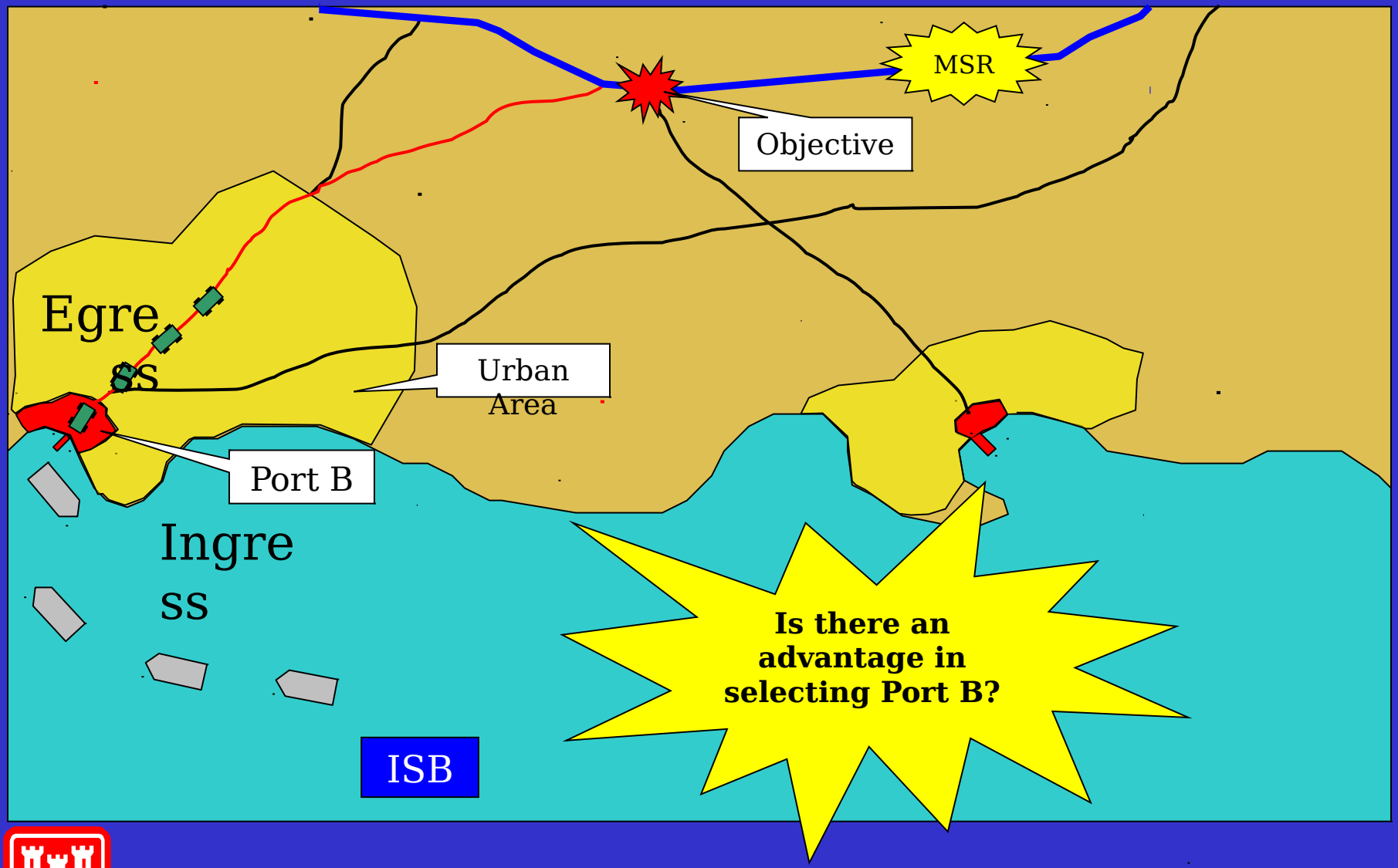
Modeling Objective Given Example Scenario



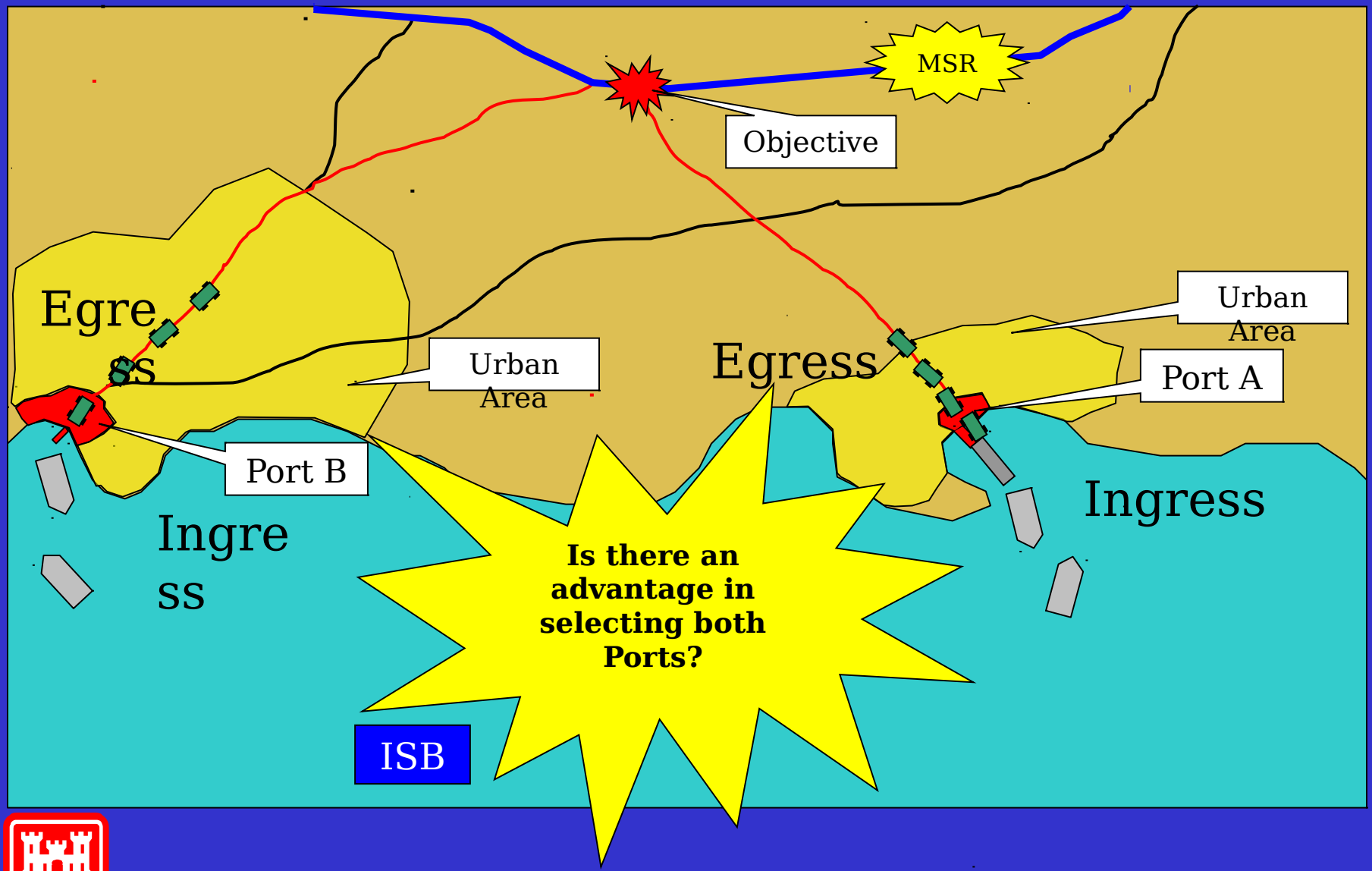
Example Scenario 1



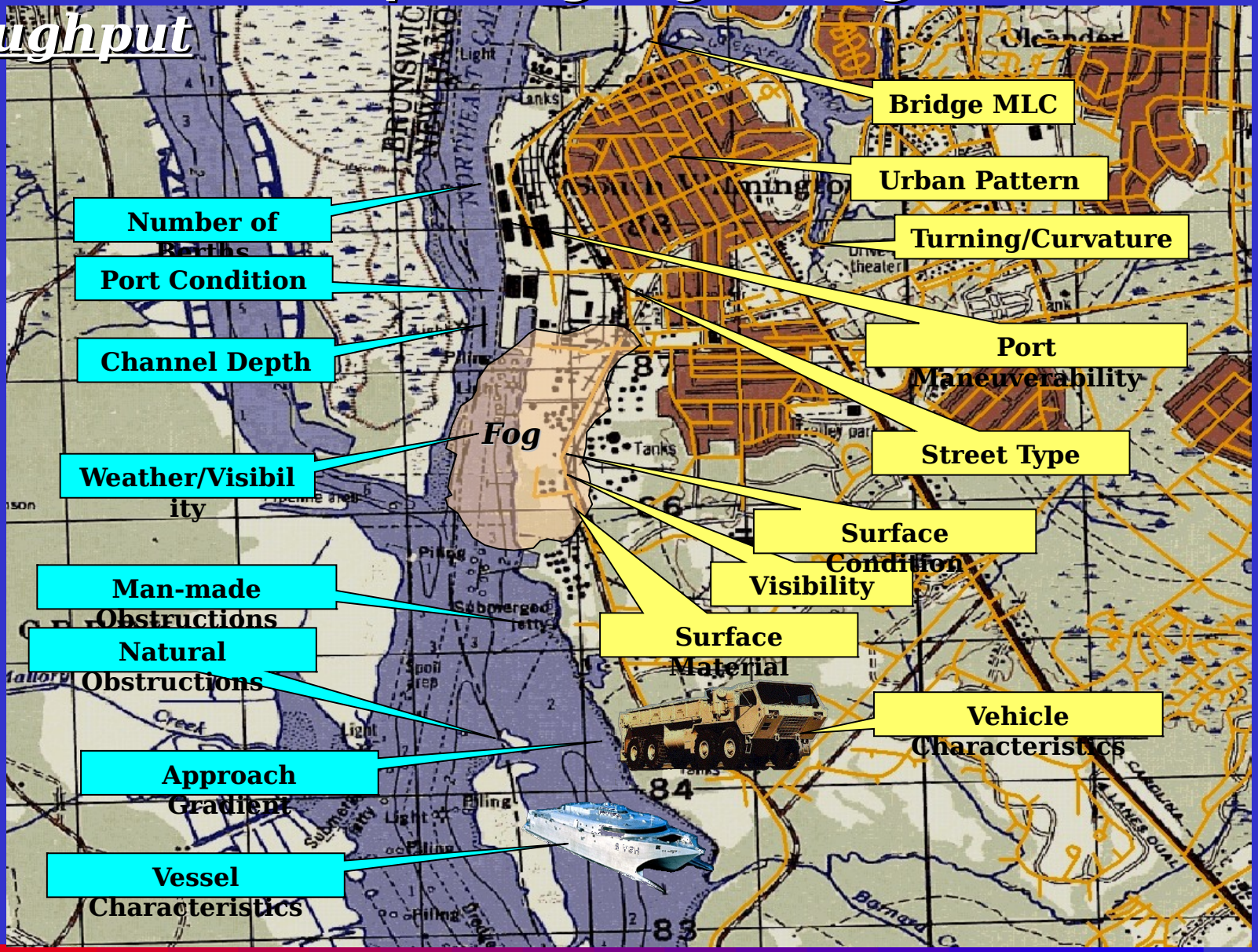
Example Scenario 2



Example Scenario 3



Critical Factors Impacting Ingress/Egress Throughput



INGRESS MODELING

Environmental Factors

- Weather - Wind, temperature, precipitation
- Surface conditions – waves, obstacles, buoys, markers
- Terrain (underwater) - bathymetry, currents, offshore & nearshore sandbars, shoreline type, basin size/shape
- Temporal - seasons, tides

Physical Factors

- Work rates - offload rates, mooring times, down times
- Structural – port & pier characteristics (i.e. berths, lanes, pier length & width, weight capacity), jettys & breakwaters, submerged obstructions
- Other – all potential impediments/bottlenecks

Relationships for Algorithms

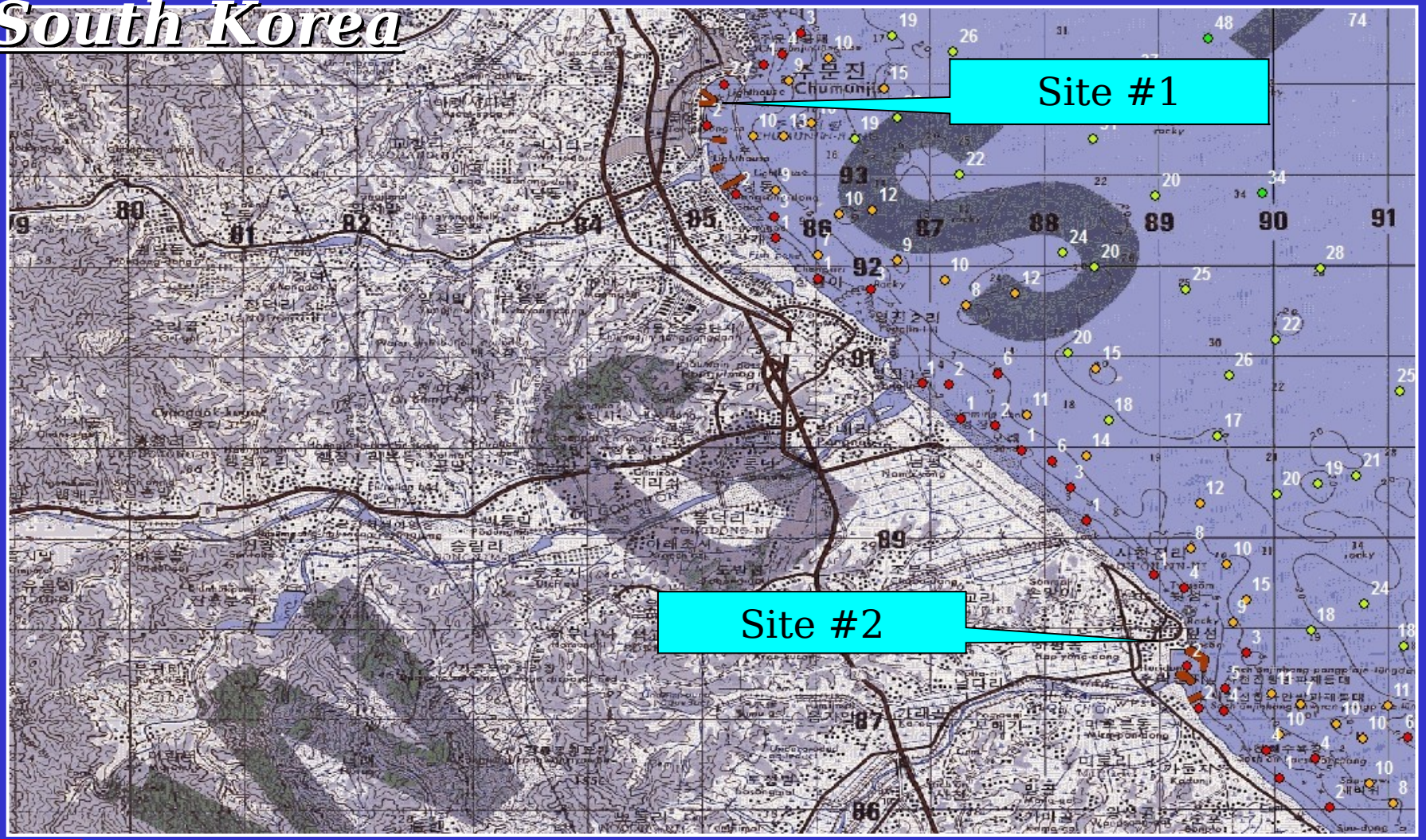
Vessel Draft vs. Limiting Water Depth

“Ramp Ready” Port vs. Rapid Port Enhancement

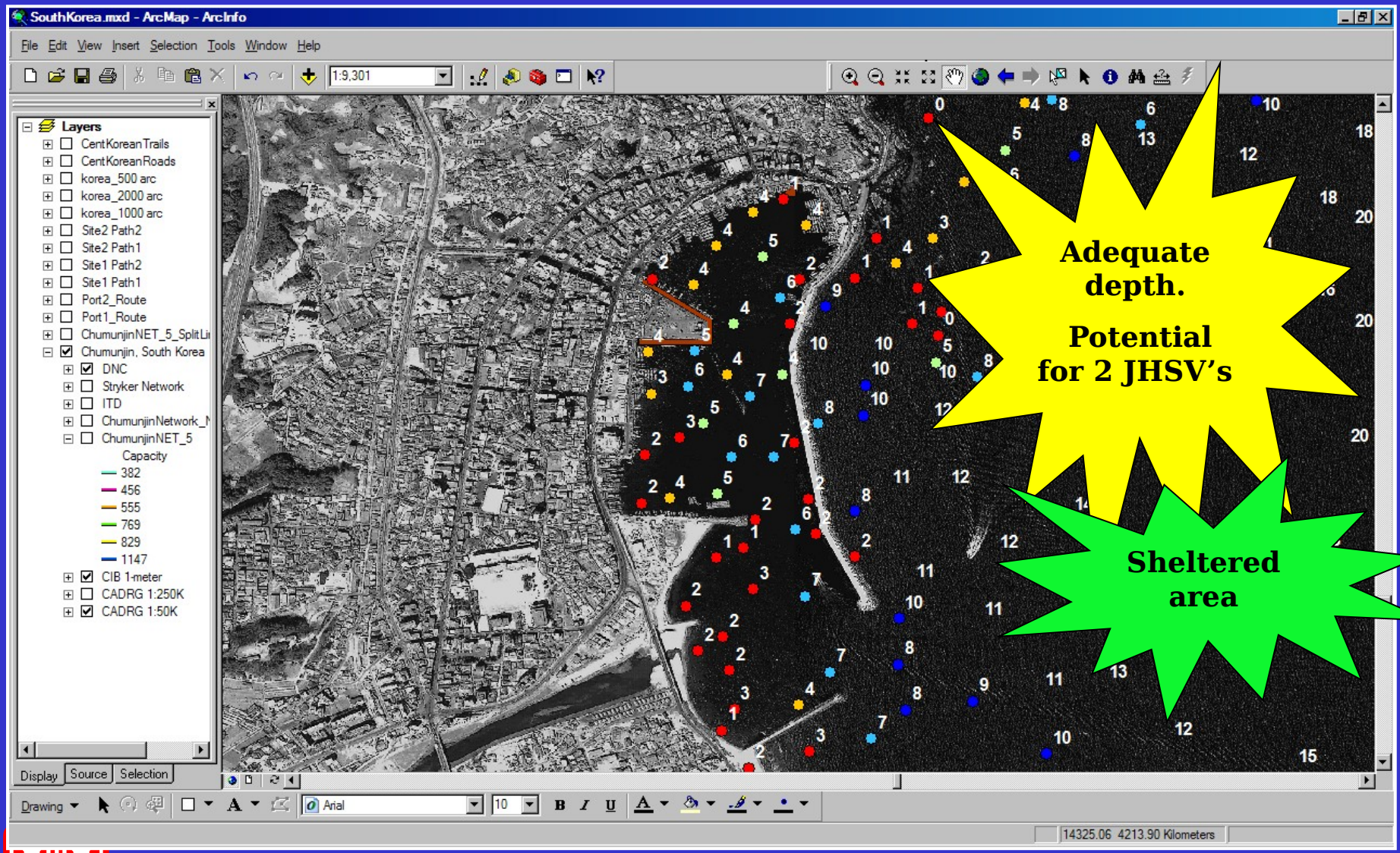
Cargo Type vs. Cargo Capabilities at Port

Cargo Weight vs. Weight Bearing Capacity at Pier

Selected Two Possible Sites on East Coast of South Korea



Site #1

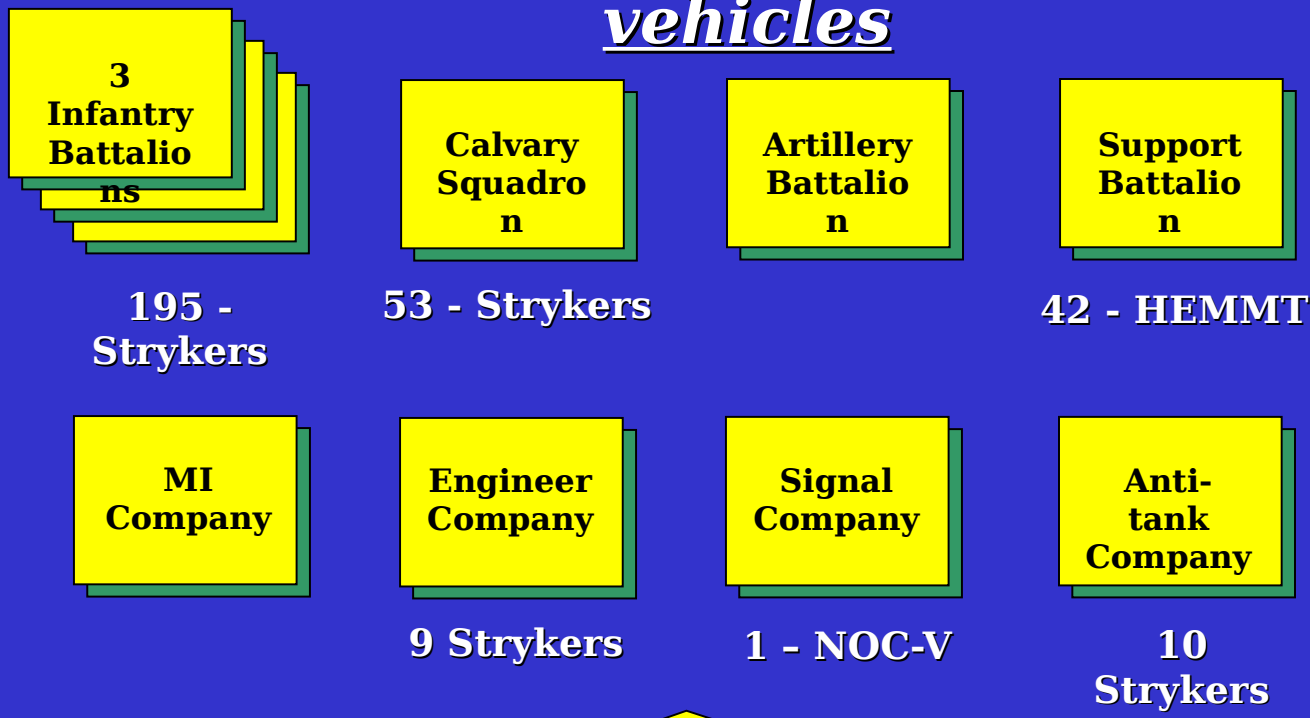

SouthKorea.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:9,301
Layers
CentKoreanTrails
CentKoreanRoads
korea_500 arc
korea_2000 arc
korea_1000 arc
Site2 Path2
Site2 Path1
Site1 Path2
Site1 Path1
Port2_Route
Port1_Route
ChumunjinNET_5_SplitLi
Chumunjin, South Korea
DNC
Stryker Network
ITD
ChumunjinNetwork_N
ChumunjinNET_5
Capacity
382
456
555
769
829
1147
CIB 1-meter
CADRG 1:250K
CADRG 1:50K
Display Source Selection
Drawing
Arial
10
14325.06 4213.90 Kilometers
Adequate depth.
Potential for 2 JHSV's
Sheltered area

Site #2

SouthKorea.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:9,301
Port2_Route
Port1_Route
ChumunjinNET_5_Sp
Chumunjin, South Kor
DNC
soundp select
hdp
1.2 - 2.8
2.9 - 4.4
4.5 - 5.4
5.5 - 7.9
8.0 - 10.1
soundp
hdp
0.2 - 2.8
2.9 - 4.4
4.5 - 5.4
5.5 - 7.9
8 - 10.1
soundp
hdp
0.0 - 6.7
6.8 - 15.6
hydline
hydline
Piers
pierl
pierl
Display Source Selection
Drawing
Arial
10
14329.32 4207.93 Kilometers
Inadequate depth.
1 JHSV using LMCS
Fair weather conditions only

Stryker Brigade Combat Team

Self-propelled, non-towed vehicles



HSV Sample Configuration with Strykers*

Table 2. MC02 Equipment List

Model Number	Description	Qty	Length (in)	Width (in)	Height (in)	Area (SqFt)	Total Area (SqFt)	Weight (STON)	Total Weight (STON)
Stryker	Inf Carrier Veh	14	284	110	109	217	3038	19	266
M1083	Trk Cgo, MTV	2	278	96	112	185	370	11.24	22.48
M149A2	Trailer Tank Water	2	162	81	81	91	182	1.5	3
M984A1	Truck Wrecker	1	402	102	102	285	285	25.2	25.2
M998A1	Trk Util Cgo	4	181	84	74	106	424	2.6	10.4
M966	Trk Utill 1 ¼ T	3	180	100	74	125	375	3.6	10.8
M1101	Tlr Cgo HIMOB ¾ Ton	1	136	86	100	81	81	0.7	0.7
M1102	Tlr Cgo HIMOB 1 ¼ Ton	1	136	86	100	81	81	0.7	0.7
	Total Equipment	**28**					**4836**		**339.28**

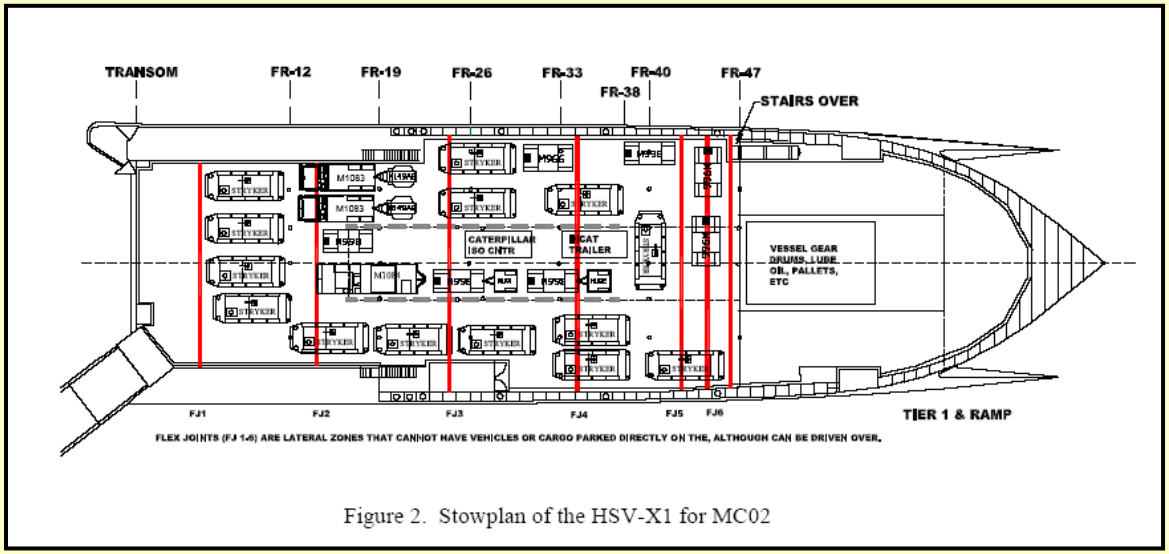


Figure 2. Stowplan of the HSV-X1 for MC02

*Source: Joint Venture (HSV-X1)

Ingress Operations Flow Diagram

Upload JHSV

Loaded JHSV departure rates from WC Port or ISB

Intra-theater open ocean transit

Channel/River Transit

Deploy LMCS

Approach/Moor & Lower Ramp

Download Cargo from JHSV

Offload Cargo

Cast-Off & Clear Port Area

Through Port

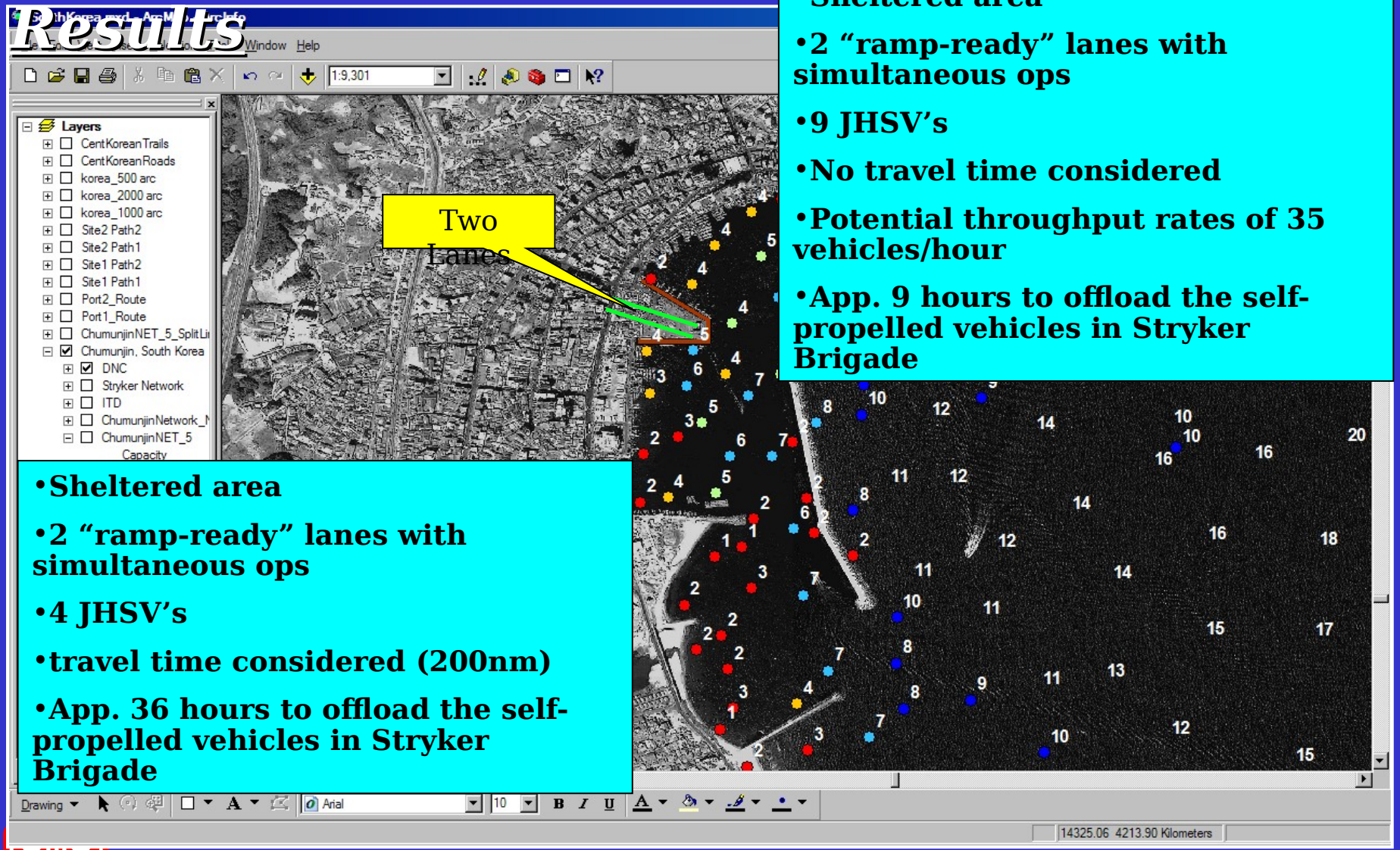
Storage

Exit Port

Feed Egress

Operations are affected by various physical/environmental factors

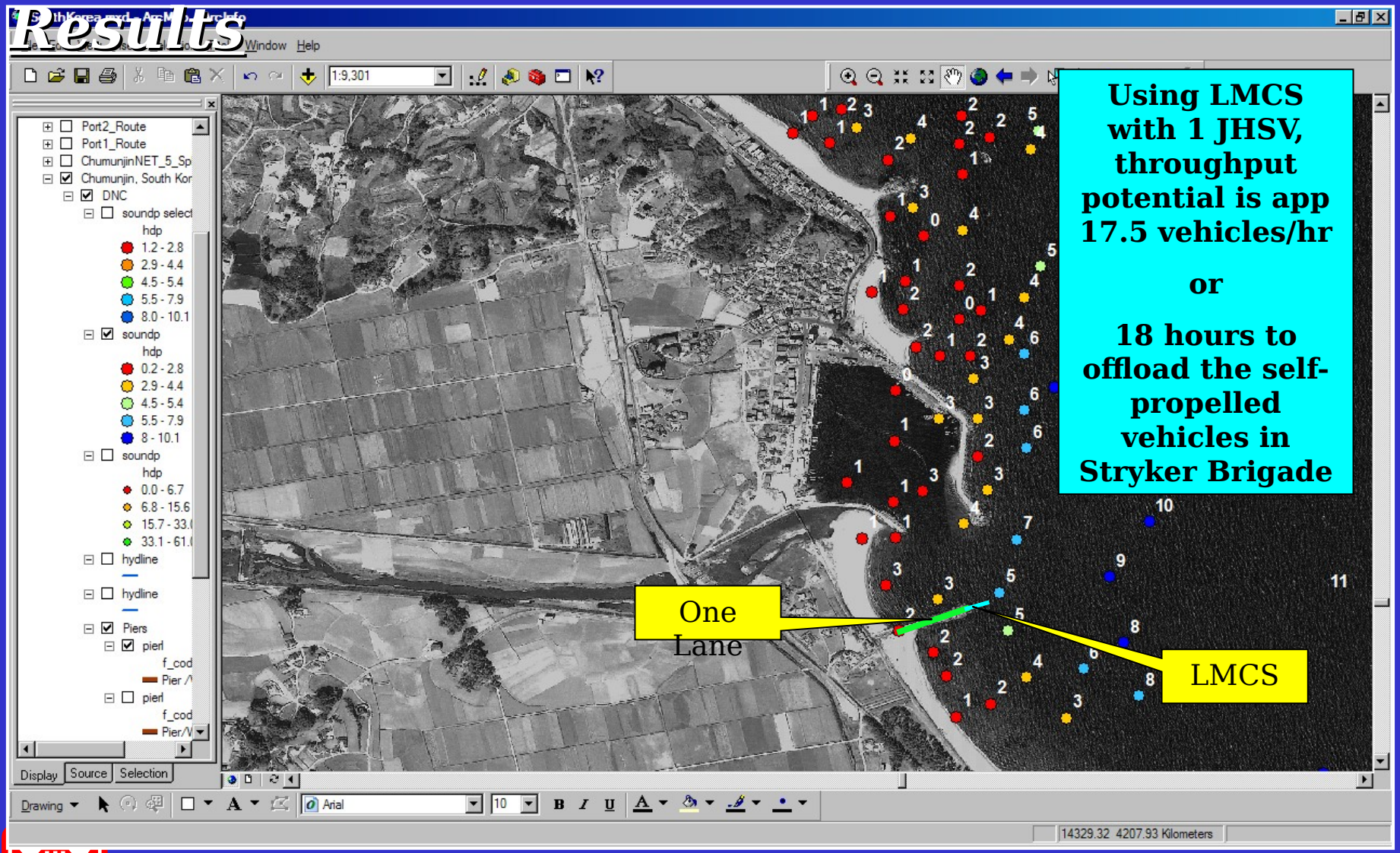
Site #1 – Preliminary Results



- Sheltered area
- 2 "ramp-ready" lanes with simultaneous ops
- 4 JHSV's
- travel time considered (200nm)
- App. 36 hours to offload the self-propelled vehicles in Stryker Brigade

- Sheltered area
- 2 "ramp-ready" lanes with simultaneous ops
- 9 JHSV's
- No travel time considered
- Potential throughput rates of 35 vehicles/hour
- App. 9 hours to offload the self-propelled vehicles in Stryker Brigade

Site #2 – Preliminary Results


Using LMCS with 1 JHSV, throughput potential is app 17.5 vehicles/hr
or
18 hours to offload the self-propelled vehicles in Stryker Brigade
One Lane
LMCS

EGRESS MODELING

PROCEDURE

Combine current mobility research with existing suite of tools to estimate throughput potential through any given austere port using sparse data.

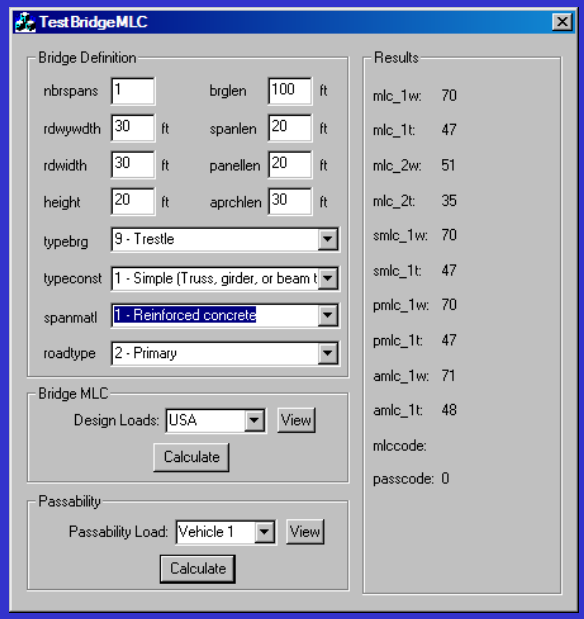
Egress Throughput Potential Modeling

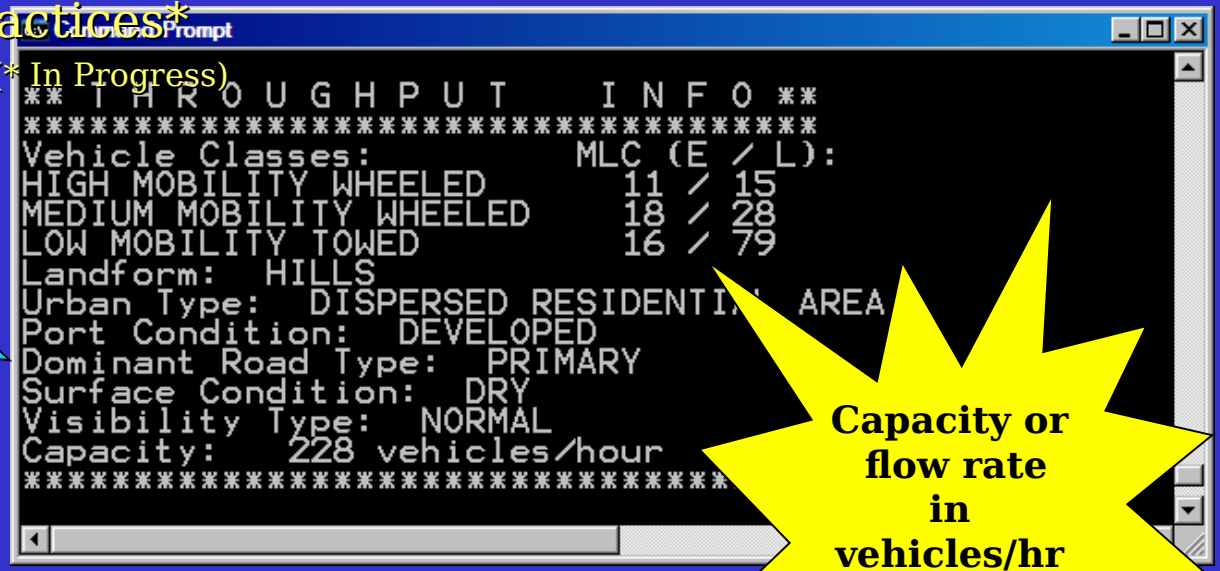
Things considered are

.....

- Vehicle types
- Vehicle mix
- Vehicle MLC
- Landform type
- Urban type
- Dam[illegible]te
- Surface type and condition
- Port condition
- Visibility condition
- Bridge MLC
- Demographics*
- Construction Practices*

(* In Progress)

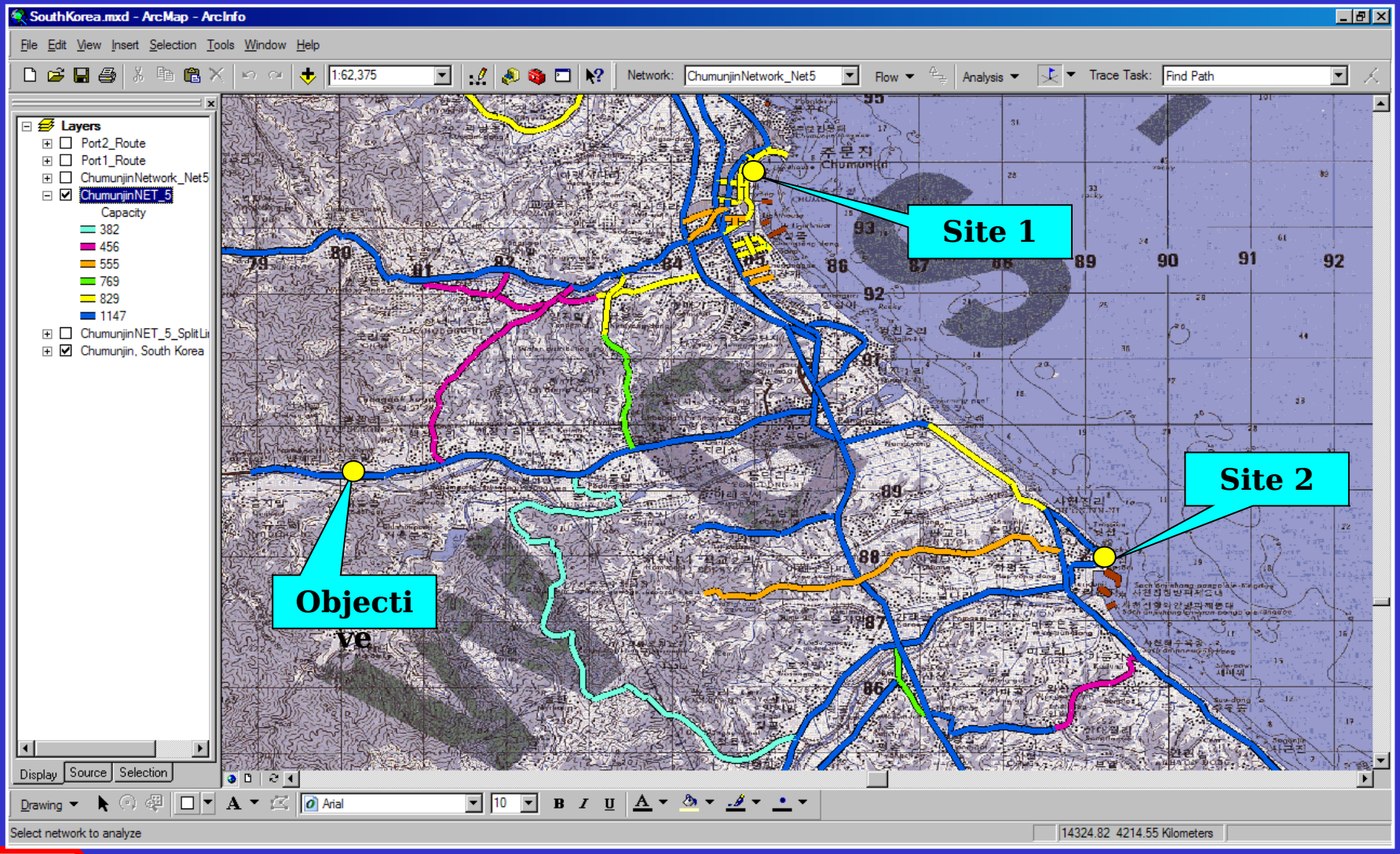



Command Prompt
** T H R O U G H P U T I N F O **
Vehicle Classes: MLC (E / L):
HIGH MOBILITY WHEELED 11 / 15
MEDIUM MOBILITY WHEELED 18 / 28
LOW MOBILITY TOWED 16 / 79
Landform: HILLS
Urban Type: DISPERSED RESIDENTI AREA
Port Condition: DEVELOPED
Dominant Road Type: PRIMARY
Surface Condition: DRY
Visibility Type: NORMAL
Capacity: 228 vehicles/hour

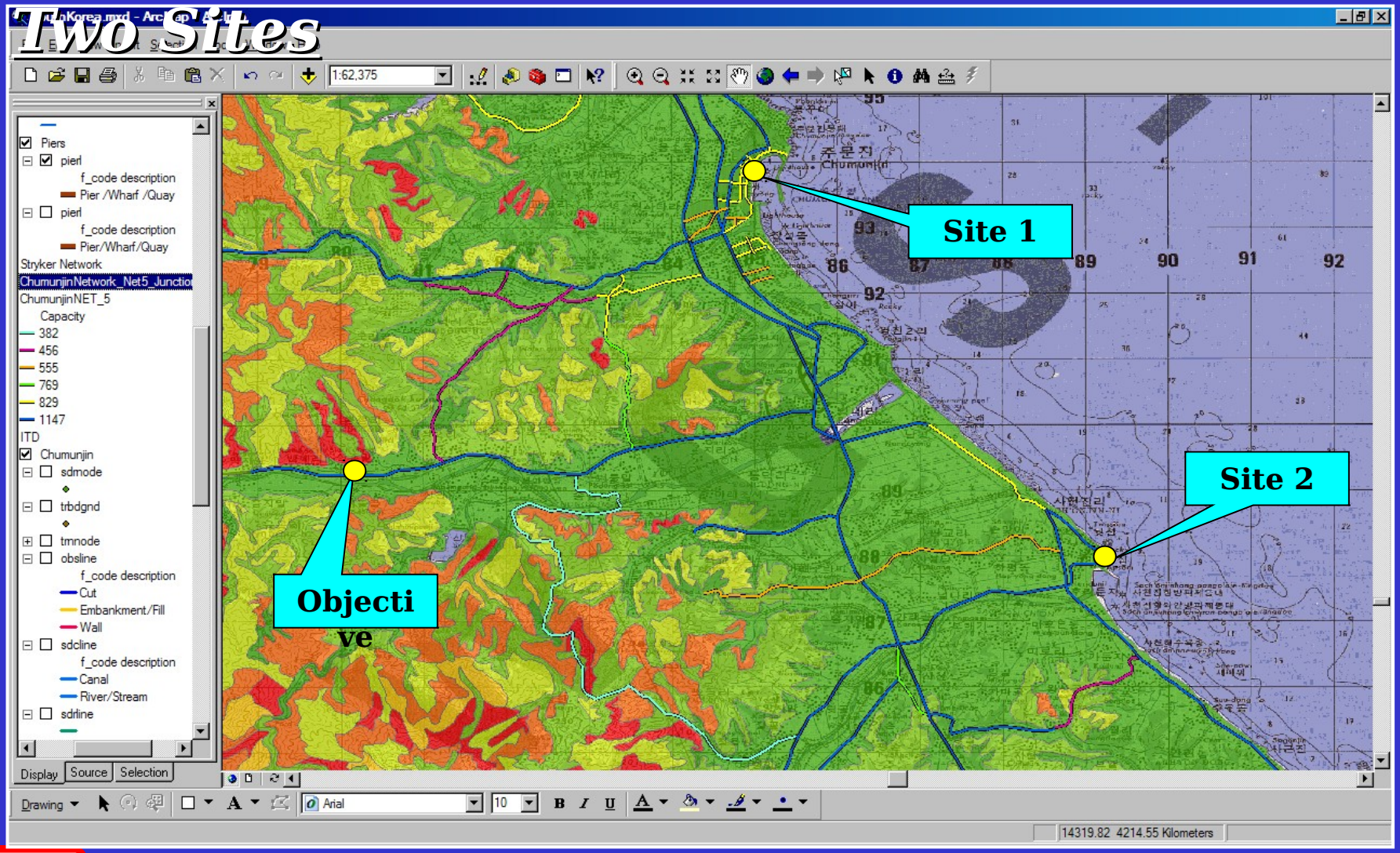
Vehicle movement rates based on NATO Reference Mobility Model

Capacity or flow rate in vehicles/hr

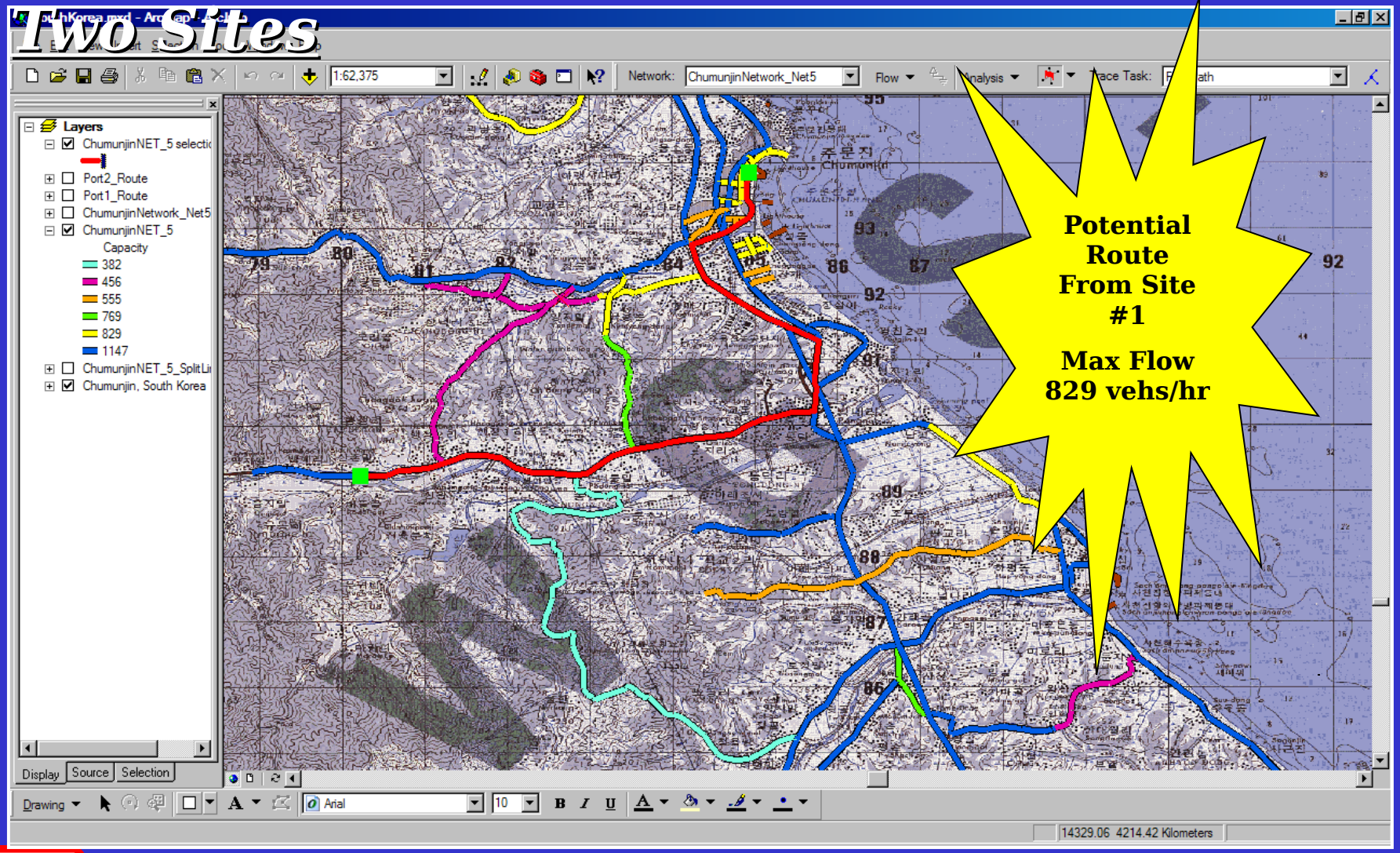
Stryker Brigade Throughput Potential At



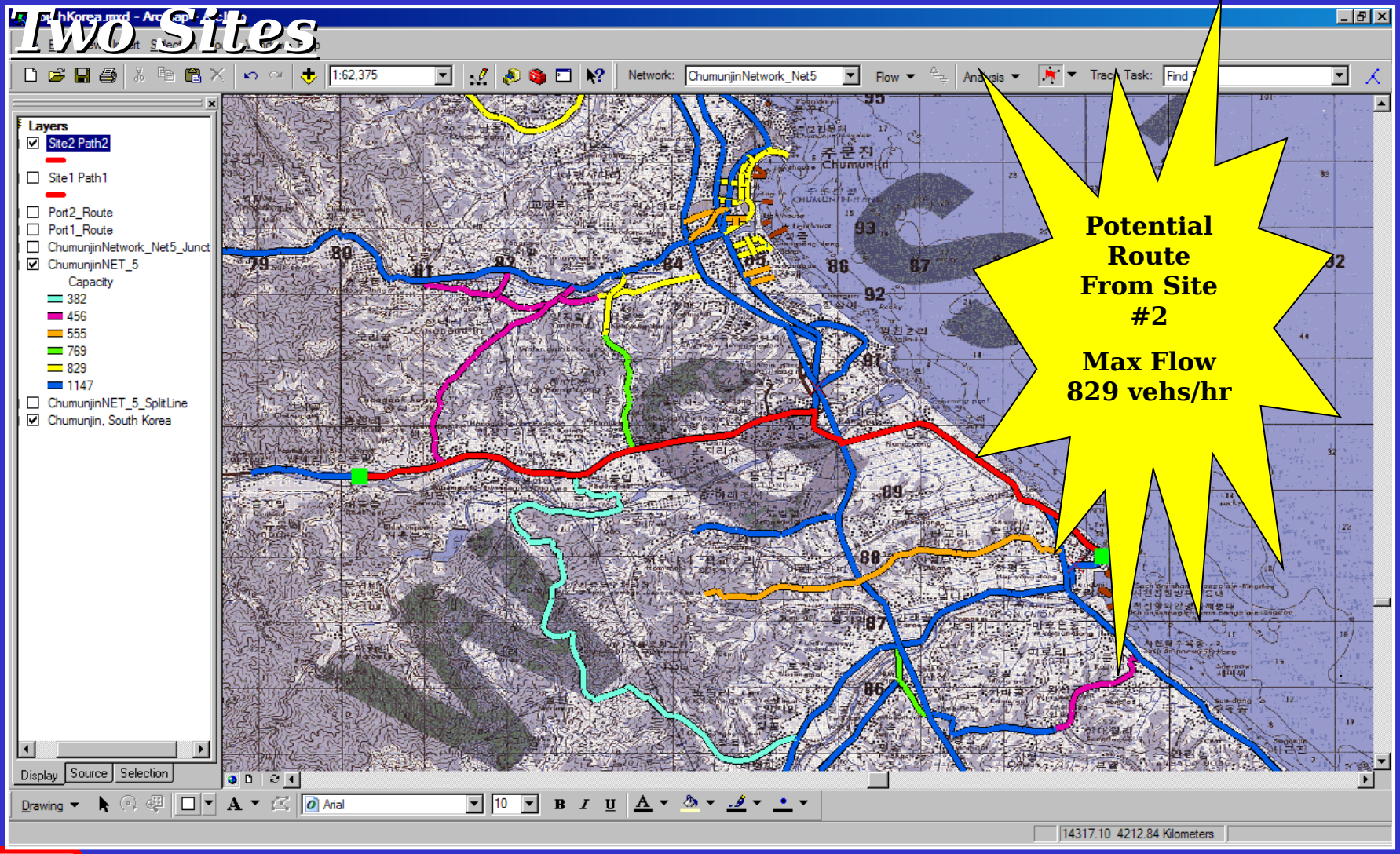
Stryker Brigade Throughput Potential At Two Sites



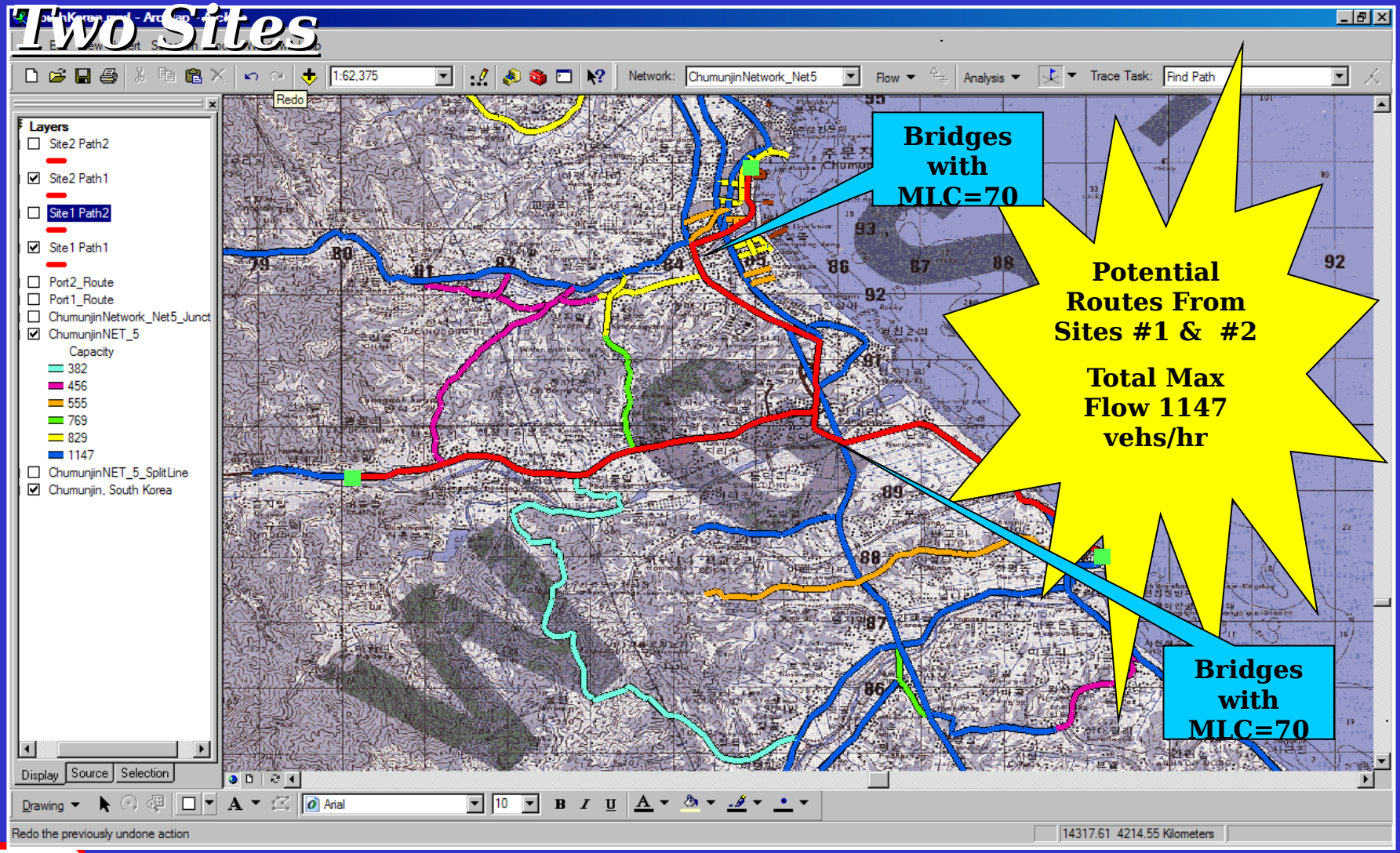
Stryker Brigade Throughput Potential At Two Sites



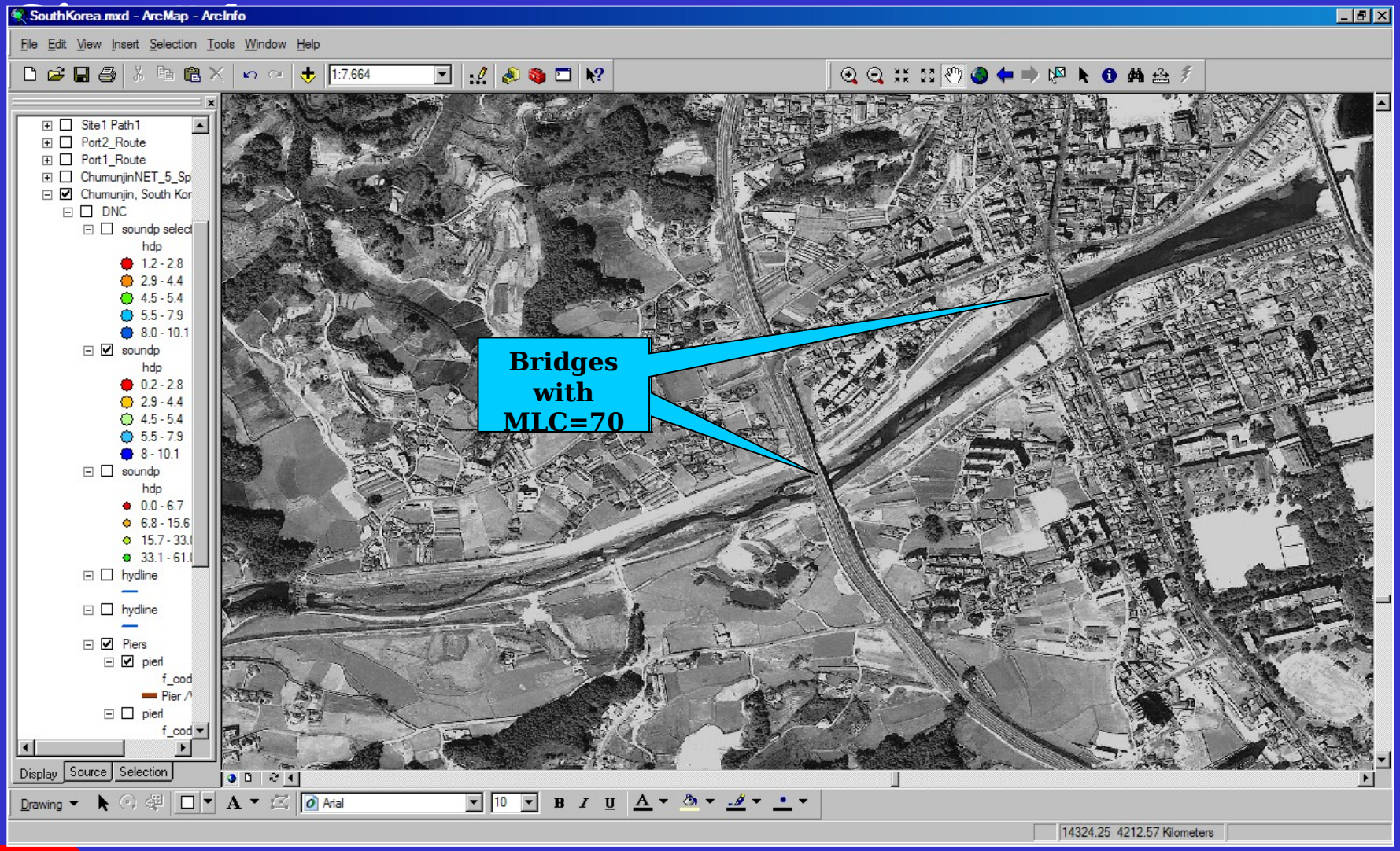
Stryker Brigade Throughput Potential At Two Sites



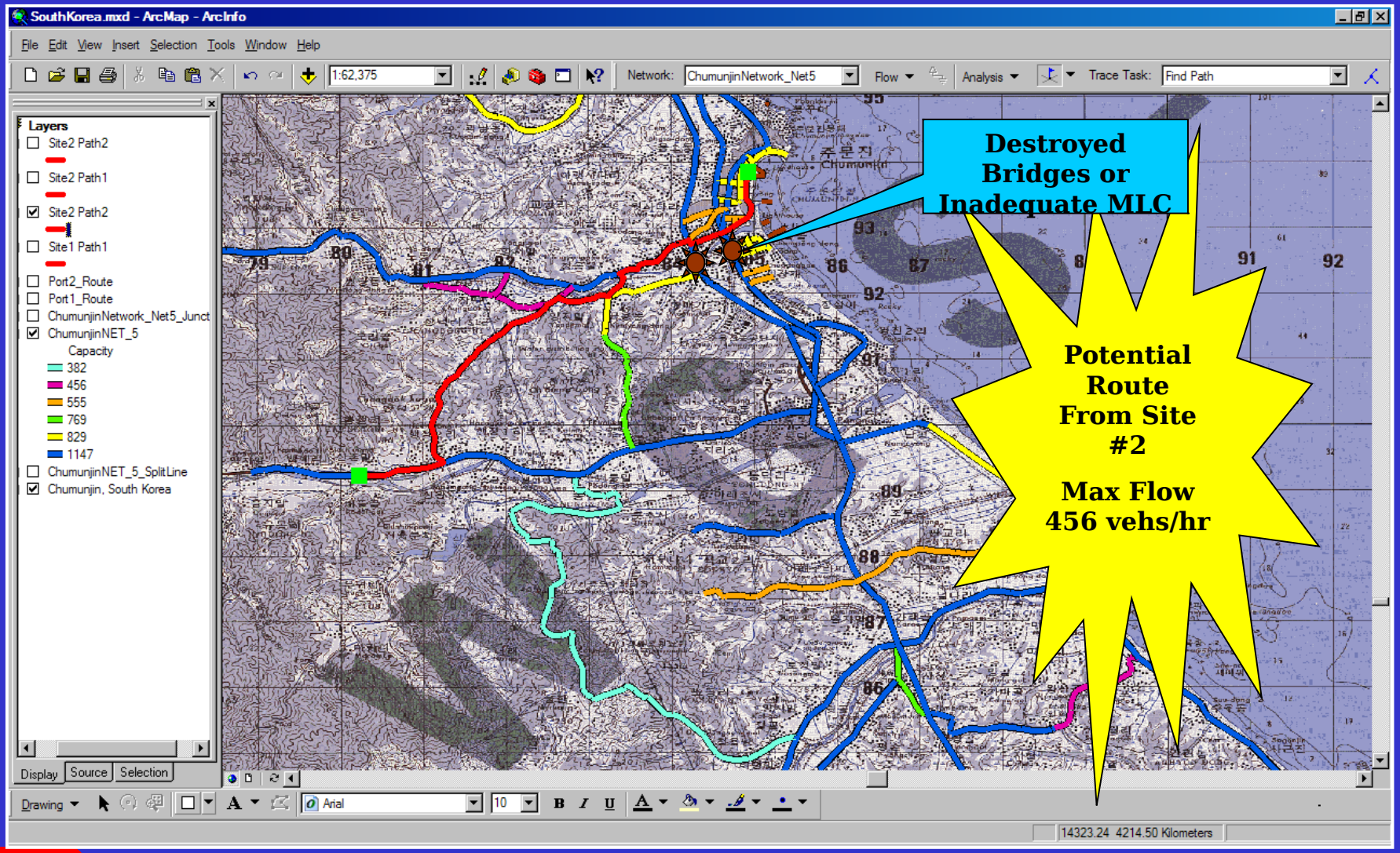
Stryker Brigade Throughput Potential At Two Sites



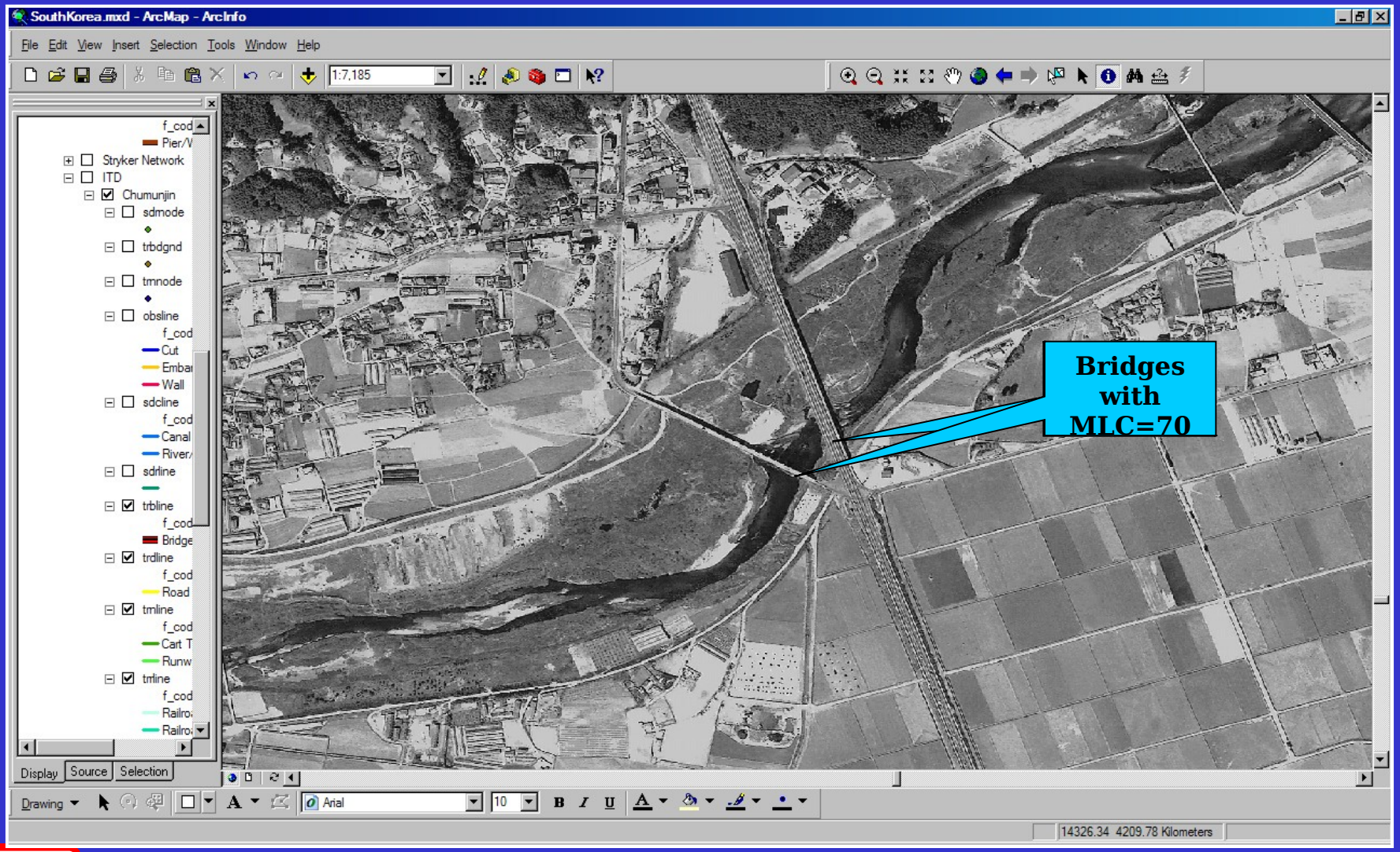
Stryker Brigade Throughput Potential At



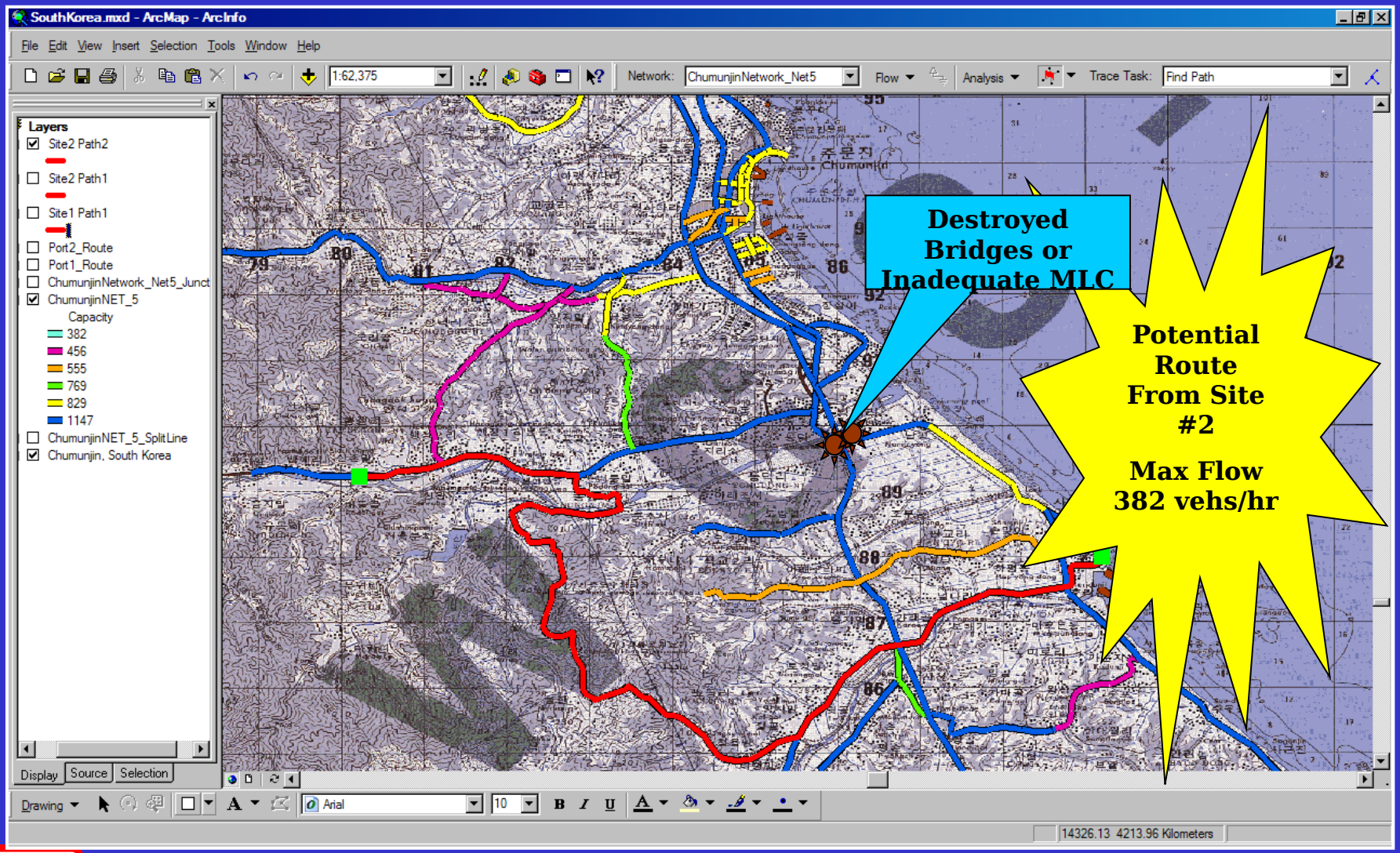
What if for Site #1....



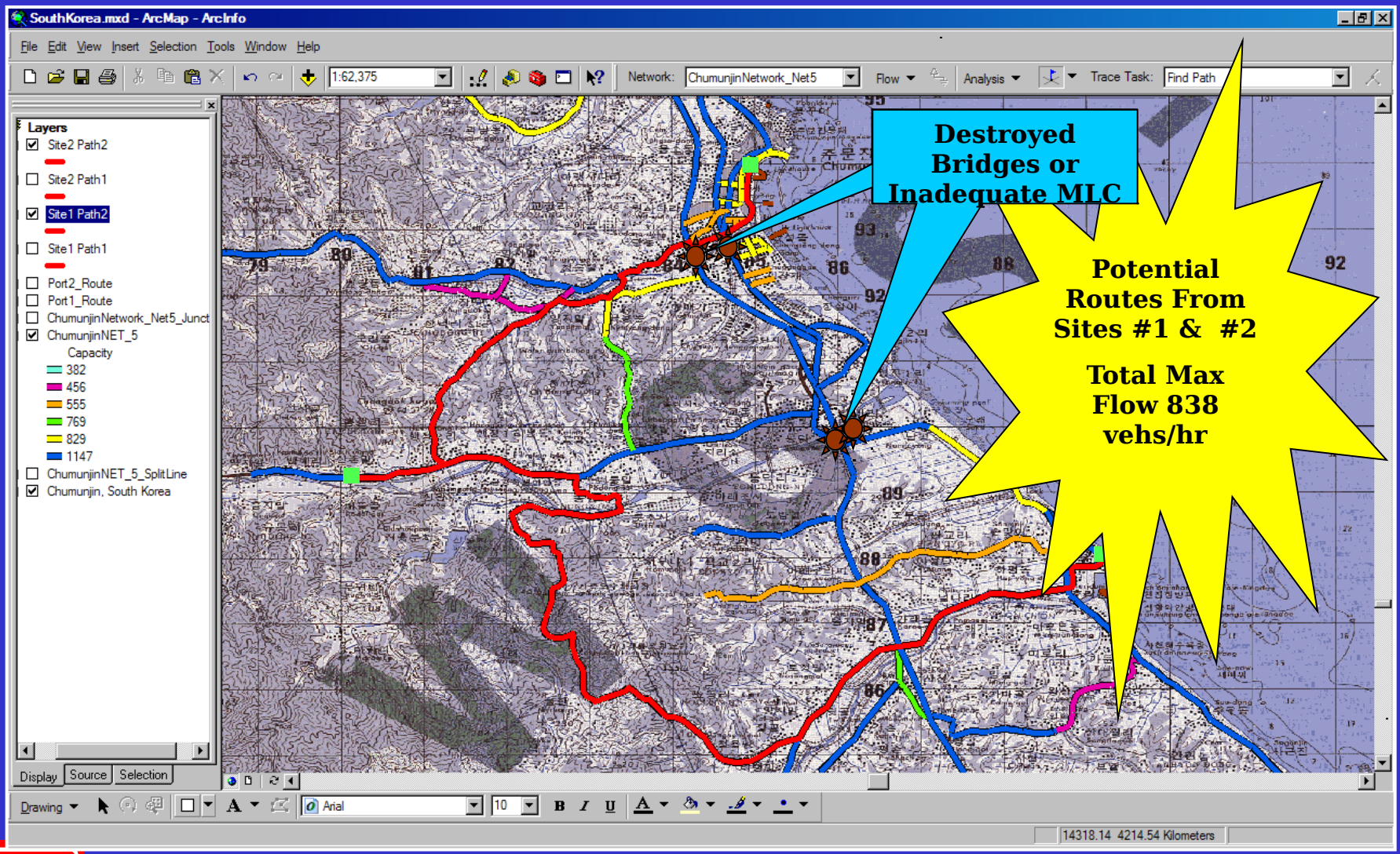
Stryker Throughput Potential At Site #2



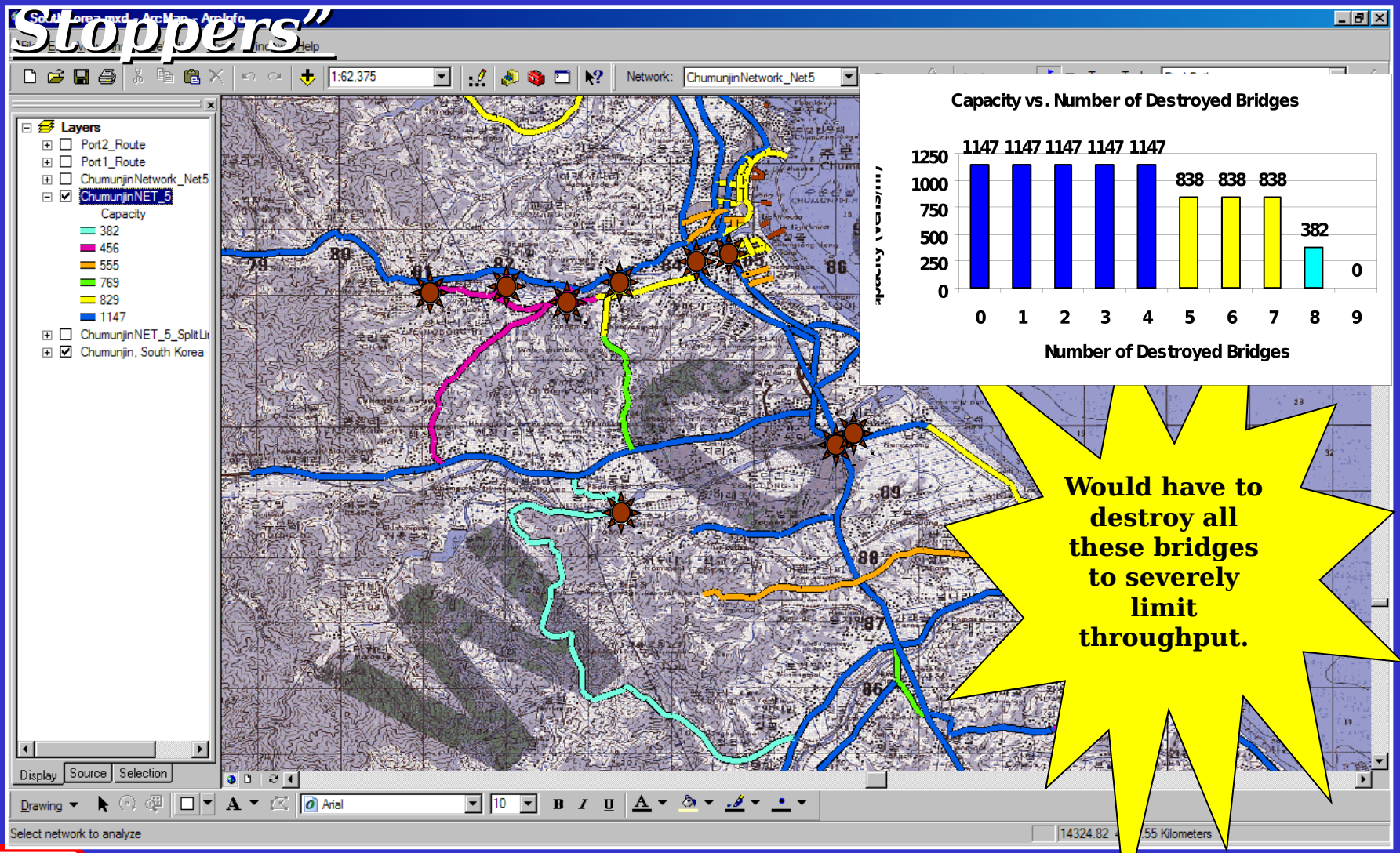
What if for Site #2....



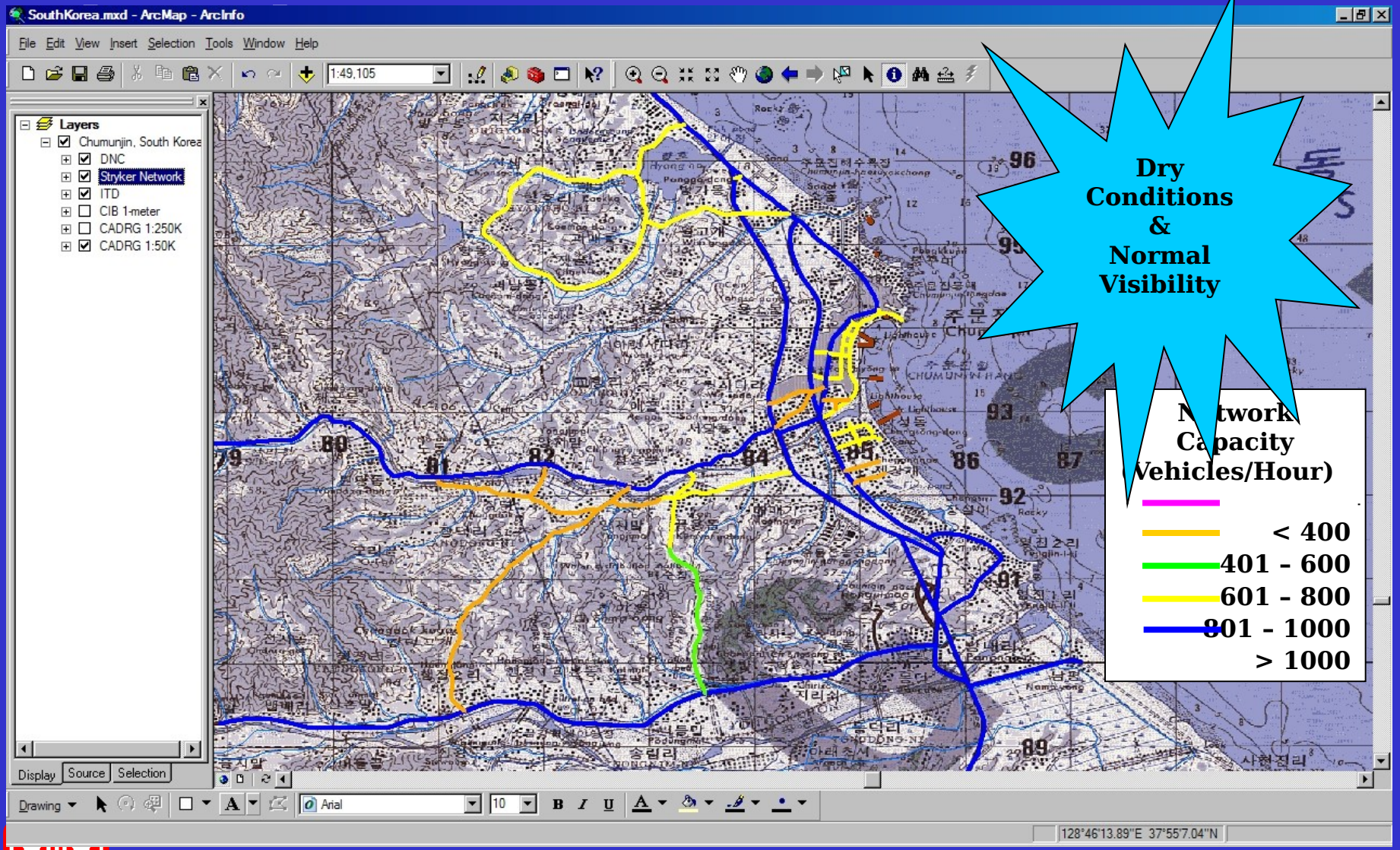
What if for Both Sites....



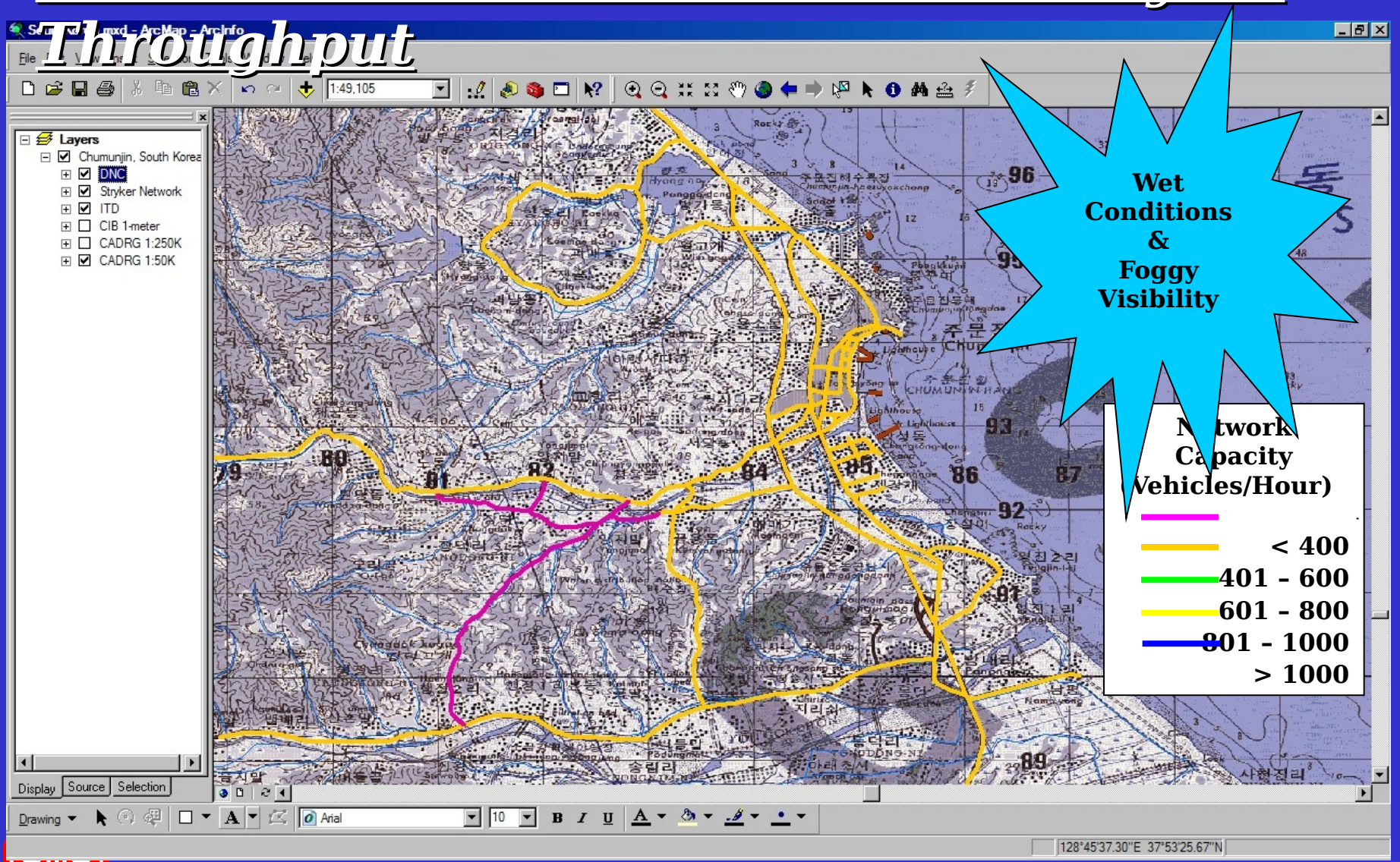
Stryker Throughput Potential "Show-Stoppers"



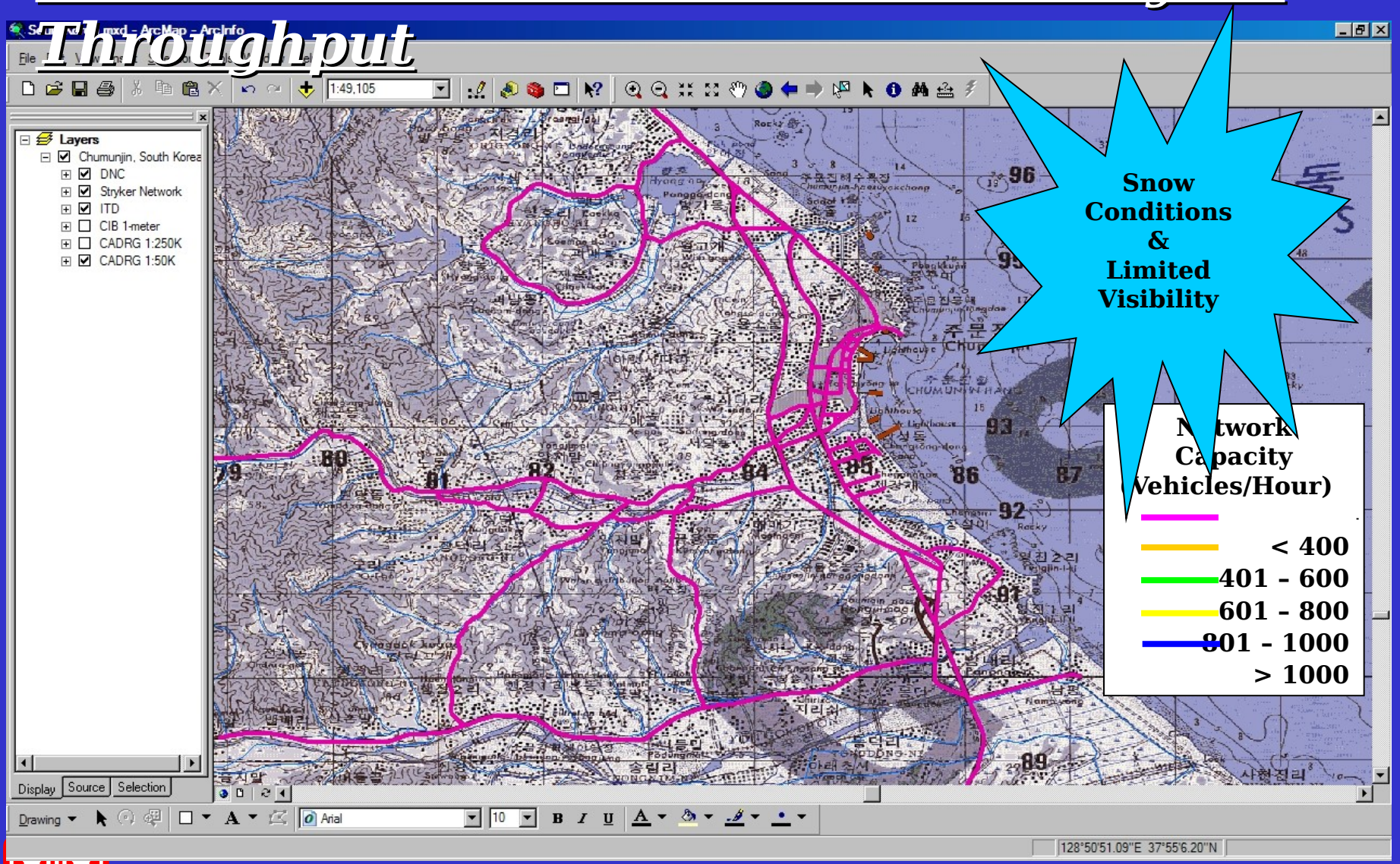
Other Factors That Could Limit Stryker



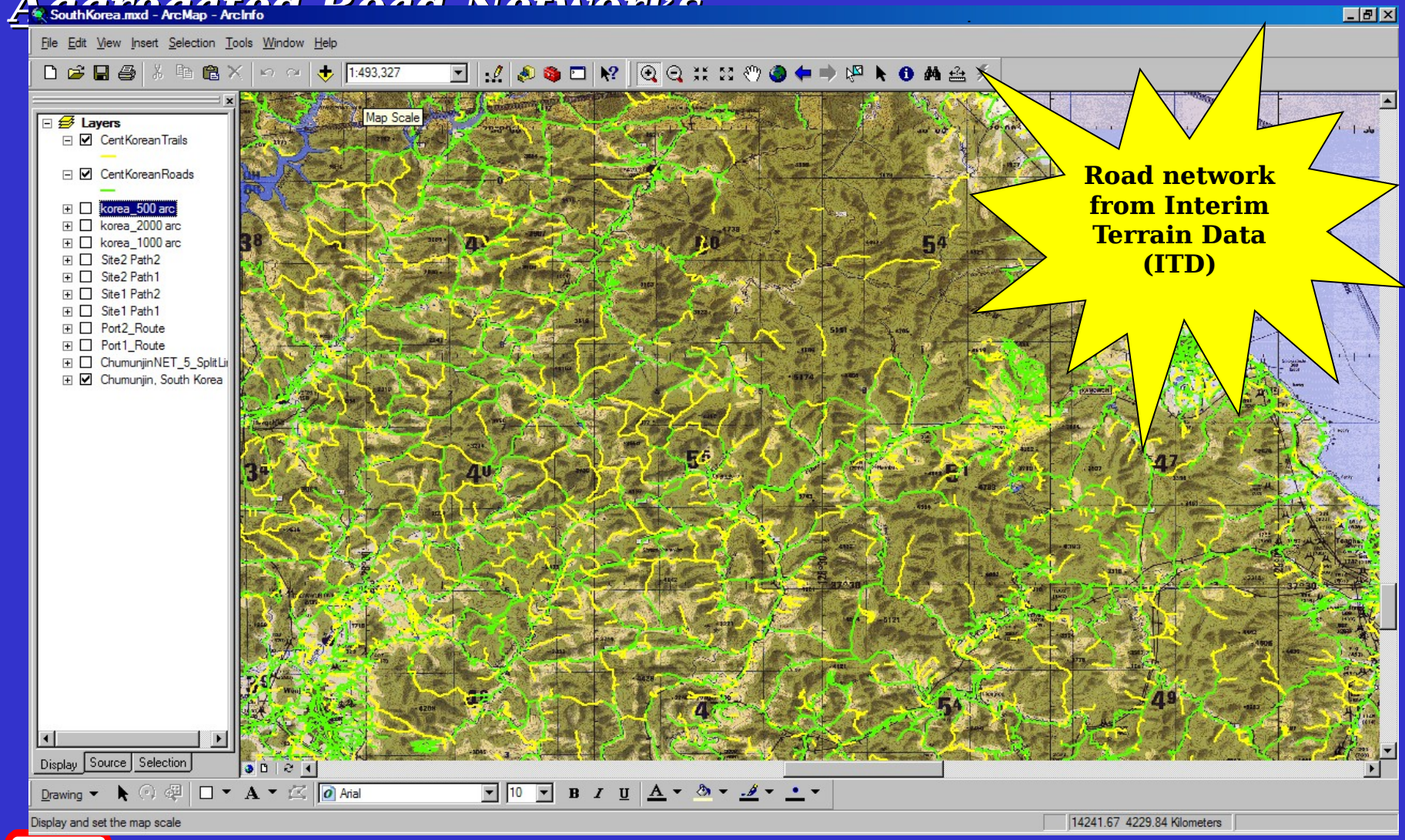
Other Factors That Could Limit Stryker Throughput



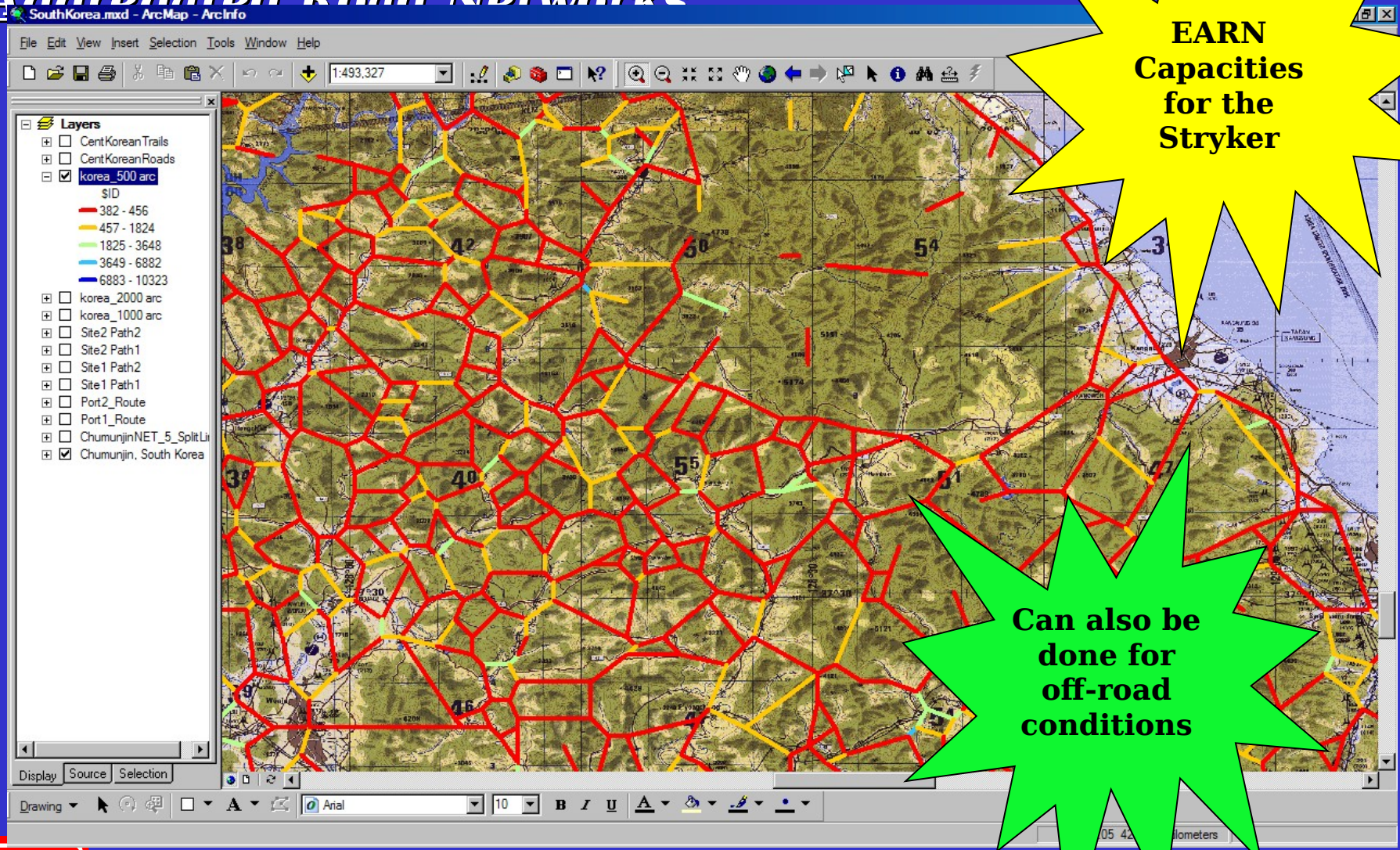
Other Factors That Could Limit Stryker Throughput



Stryker Throughput Potential Using Equivalent Aggregated Road Networks



Stryker Throughput Potential Using Equivalent Aggregated Road Networks



CONCLUSIONS

- Can predict throughput using existing tools along with models being developed through current research.
- Road networks, even in austere areas, appear to exceed port capacities.
- The combined tools show that small ports can be used for effective theater access.

QUESTIONS?